



Lawrence Livermore National Laboratory is committed to enhancing its environmental stewardship and the steps it takes to reduce any potential impacts its operations may have on the environment. The Environmental Protection Department (EPD) is the lead organization at LLNL that provides environmental expertise and guidance for LLNL operations. This chapter provides a description of EPD's departments and activities. One of the most important activities in 2005 was the integration of the International Organization for Standardization (ISO) 14001:1996 Environmental Management System (EMS) requirements into the Integrated Safety Management System (ISMS). This process of developing LLNL's EMS is described in detail. Pollution Prevention (P2), a significant component of EMS, plays an important role at LLNL. The progress made by P2 in meeting DOE pollution protection goals, diverting waste, and tackling projects that reduce the quantity of waste being generated is itemized. Award winning projects, Energy Management Program Projects, and Training and Awareness Programs are also described.

## Environmental Protection Department

EPD is responsible for environmental monitoring, environmental regulatory interpretation and implementation guidance, environmental restoration, environmental community relations, and waste management in support of LLNL's programs. EPD prepares and maintains environmental plans, reports, and permits; maintains the environmental portions of the ES&H Manual; informs management about pending changes in environmental regulations pertinent to LLNL; represents LLNL in day-to-day interactions with regulatory agencies and the public; and assesses the effectiveness of

pollution control programs. EPD has also taken the leadership role in the decommissioning and decontamination (D&D) of facilities at LLNL to adapt to changes in programs resulting from the end of the Cold War. EPD's Space Action Team tactically implements LLNL's institutional D&D activities. Since 1994, 168 real property facilities encompassing 481,686 gross square feet have been removed from LLNL.

EPD monitors air, sewerable water, groundwater, surface water, rain, soil, sediment, vegetation, and foodstuff, as well as direct radiation; evaluates possible contaminant sources; and models the impact of LLNL operations on humans and the environment. These monitoring activities in 2005 are presented in the remaining chapters of this report.

A principal part of EPD's mission is to work with LLNL programs to ensure that operations are conducted in a manner that limits environmental impacts and is in compliance with regulatory requirements. EPD helps LLNL programs manage and minimize hazardous, radioactive, and mixed wastes, as well as identify opportunities for pollution prevention, including minimization of nonhazardous waste; determines the concentrations of environmental contaminants remaining from past activities; cleans up environmental contamination to acceptable standards; responds to emergencies in order to minimize and assess any impact on the environment and the public; and provides training programs to improve the ability of LLNL employees to comply with environmental regulations. These functions are organized into three divisions within the department: Operations and Regulatory Affairs (ORAD), Radioactive and Hazardous Waste Management (RHWM), and Environmental Restoration (ERD).

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## Operations and Regulatory Affairs Division

The Operations and Regulatory Affairs Division (ORAD) consists of six groups that specialize in environmental compliance and monitoring and provide LLNL programs with a wide range of information, data, and guidance to make more informed environmental decisions. ORAD prepares the environmental permit applications and related documents for submittal to federal, state, and local agencies; provides the liaison between LLNL and regulatory agencies conducting environmental inspections; tracks chemical inventories; prepares NEPA documents and conducts related field studies; oversees wetland protection and floodplain management requirements; coordinates cultural and wildlife resource protection and management; facilitates and provides support for the pollution prevention and recycling programs; teaches environmental training courses; coordinates the tank environmental compliance program; coordinates Spill Prevention Control and Countermeasure and Storm Water compliance programs; coordinates wastewater discharge compliance programs; provides guidance to LLNL

operations on regulatory requirements and compliance strategies; conducts compliance and surveillance monitoring; provides environmental impact modeling and analysis, risk assessment, and reporting; and develops new methods and innovative applications of existing technologies to improve environmental practices and assist LLNL in achieving its mission. ORAD interacts with the community on these issues through Environmental Community Relations. ORAD also actively assists in responding to environmental emergencies such as spills. During normal working hours, an environmental analyst from the ORAD Environmental Operations Group (EOG) responds to environmental emergencies and notifies a specially trained Environmental Duty Officer (EDO). EDOs are on duty 24 hours a day, 7 days a week, and coordinate emergency response with other first responders and environmental specialists.

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## Radioactive and Hazardous Waste Management Division

The Radioactive and Hazardous Waste Management (RHWM) Division manages all hazardous, radioactive, and mixed wastes generated at LLNL facilities in accordance with local, state and federal requirements. RHWM processes, stores, packages, treats, and prepares waste for shipment and disposal, recycling, or discharge to the sanitary sewer. As part of its waste management activities, RHWM tracks and documents the movement of hazardous, mixed, and radioactive wastes from waste accumulation areas, which are typically located near the waste generator, to final disposition; develops and implements approved standard operating procedures; decontaminates LLNL equipment; ensures that containers for shipment of waste meet the specifications of the U.S. Department of Transportation and other regulatory agencies; responds to emergencies; and participates in the cleanup of potential hazardous and radioactive spills at LLNL facilities. RHWM prepares numerous reports, including the annual and biennial hazardous waste reports required by the California and U.S. Environmental Protection Agencies. RHWM also prepares waste acceptance criteria documents, safety analysis reports, and various waste guidance and management plans.

RHWM meets regulations for the treatment of LLNL's mixed waste in accordance with the requirements of the Federal Facilities Compliance Act. The schedule for this treatment is negotiated with the State of California and involves developing new on-site treatment options as well as finding off-site alternatives. RHWM is also responsible for implementing a program directed at eliminating the backlog of legacy waste (waste that is not at present certified for disposal). This effort includes a large characterization program to identify all components of the waste and a certification effort that provides appropriate documentation for the disposal site.

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## Environmental Restoration Division

The Environmental Restoration Division (ERD) was established to evaluate and remediate soil and groundwater contaminated by past hazardous materials handling and disposal practices and from leaks and spills that have occurred at the Livermore site and Site 300, both prior to and during LLNL operations. ERD conducts field investigations at both the Livermore site and Site 300 to characterize the existence, extent, and impact of contamination. ERD evaluates and develops various remediation technologies, makes recommendations, and implements actions for site restoration. ERD is responsible for managing remedial activities, such as soil removal and groundwater and soil vapor extraction and treatment, and for assisting in closing inactive facilities in a manner designed to prevent environmental contamination. As part of its responsibility for CERCLA compliance issues, ERD plans, directs, and conducts assessments to determine both the impact of past releases on the environment and the restoration activities needed to reduce contaminant concentrations to protect human health and the environment. ERD interacts with the community on these issues through Environmental Community Relations. Public workshops are held regularly, and information is provided to the public as required in the ERD CERCLA Community Relations Plans. These CERCLA activities in 2005 are summarized in the “[Environmental Restoration and Waste Management](#)” section in [Chapter 2](#). ERD's groundwater remediation activities in 2005 are further described in [Chapter 8](#).

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## Response to Spills and Other Environmental Emergencies

All spills and leaks (releases) at LLNL that are potentially hazardous to the environment are investigated and evaluated. The release response process includes identifying the release, shutting off the source (if it is safe to do so), eliminating ignition sources, contacting appropriate emergency personnel, cordoning off the area containing the released material, absorbing and neutralizing the released material, assisting in cleanup, determining if a release must be reported to regulatory agencies, and verifying that cleanup (including decontaminating and replenishing spill equipment) is complete. ORAD staff also provide guidance to the programs on preventing spill recurrence.

As previously described, the EDO is available 24 hours a day, 7 days a week to maximize efficient and effective emergency environmental response. Specialized EDO training includes simulated incidents to provide the response personnel with the experience of working together to mitigate an environmental emergency, determine any reporting requirements to regulatory agencies and DOE, and resolve environmental and regulatory

issues within the LLNL emergency response organization. The on-duty EDO can be reached by pager or cellular phone at any time.

During normal work hours, LLNL employees report any environmental incidents to an EOG environmental analyst assigned to support their program area. The EOG environmental analyst then notifies the on-duty EDO of the incident, and together with other ORAD staff, the team determines applicable reporting requirements to local, state, and federal regulatory agencies and to DOE. The EDO and the EOG environmental analyst also notify and consult with program management and have 7-day-a-week, 24-hour-a-day access to the office of Laboratory Counsel for questions concerning regulatory reporting requirements.

During off hours, LLNL employees report all environmental incidents to the Fire Dispatcher, who, in turn, notifies the EDO and the Fire Department, if required. The EDO then calls out additional EPD support to the incident scene as necessary, and follows the same procedures as outlined above for normal work hours.

## Integrated Safety Management System

LLNL implements an Integrated Safety Management System (ISMS) designed to ensure the systematic integration of environment, safety, and health (ES&H) considerations into management and work practices so that missions are accomplished safely. "Safety," used in this context, is synonymous with environment, safety, and health to encompass protection of the public, workers, and the environment, including pollution prevention and waste minimization. LLNL regards protection of the environment as an essential component in its overall safety management system.

The core requirements of ISMS are based on DOE's Seven Guiding Principles summarized as: (1) line management responsibility for safety; (2) clear roles and responsibilities; (3) competence commensurate with responsibilities; (4) balanced priorities; (5) identification of safety standards and requirements; (6) hazard/environmental aspect controls tailored to work being performed; (7) operations authorization. How LLNL manages and performs work can be described by the Five Core Functions: (1) define the scope of work; (2) analyze the hazards/environmental aspects; (3) develop and implement hazard/environmental aspect controls; (4) perform work within controls; and (5) provide feedback and continuous improvement.

In 2005 LLNL enhanced the environmental emphasis of the ISMS based on the International Organization for Standardization (ISO) standard 14001:1996, Environmental Management Systems. ISO 14001 defines an EMS as "that part of the overall management system that includes



organizational structure, planning activities, responsibilities, practices, procedures, processes, and resources for developing, implementing, achieving, reviewing and maintaining the environmental policy." The EMS is based on requirements relating to the following five EMS principles: 1) define an environmental policy and ensure commitment to its EMS; 2) formulate a plan to fulfill the environmental policy; 3) develop the capabilities and support mechanisms necessary to achieve the environmental policy, objectives, and targets; 4) measure, monitor, and evaluate environmental performance; and 5) review and continually improve the environmental management system with the objective of improving overall environmental performance.

The implementation of a management system based on all these principles and functions results in accountability at all levels of the organization, project planning with environmental protection in mind, and excellence in program execution. The ISMS Program at LLNL employs a process of assessing hazards and the environmental implications of work; designing and implementing standards-based methods intended to control risks and reduce the negative impacts of work activities to meet established targets and objectives; and complying with applicable ES&H requirements. The ISMS effective at LLNL in 2005 was *Integrated Safety Management System Description, Version 8* (LLNL 2005) which can be found at [http://www.llnl.gov/es\\_and\\_h/ism/ism-descriptionv8.pdf](http://www.llnl.gov/es_and_h/ism/ism-descriptionv8.pdf).

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## Work Smart Standards

Work Smart Standards (WSS) establish workplace ES&H controls and are an integral part of the LLNL ISMS. This comprehensive set of standards (applicable laws, regulations, DOE orders, etc.) defines the ES&H requirements for LLNL and is used by ES&H professionals to identify hazards and environmental aspects<sup>1</sup>, and establish standards of operation appropriate for a particular work environment. The original WSS were selected using the necessary and sufficient process, which involves review and recommendation by LLNL subject matter experts (SMEs) and their DOE counterparts. The WSS are continually reviewed and revised through a formal change control process when applicable DOE orders or regulations are issued or adopted. The Change Control Board (CCB), which consists of representatives from DOE, UC, and LLNL, manages the change control process. In addition, LLNL SMEs perform periodic review of all the requirements to ensure that the WSS set is current and complete.

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<sup>1</sup> *Environmental aspects* are elements of an organization's activities, products, or services that can interact with the environment.

The WSS set currently identified to satisfy the ES&H needs of the LLNL work environment is in Appendix G of the UC contract, and can be viewed at <http://labs.ucop.edu/internet/wss/wss.html>.

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## Environmental Management System

The LLNL EMS was designed to meet the requirements of ISO 14001:1996, which was adopted by LLNL as a WSS in June 2004. In 2005, LLNL began the process of integrating ISO 14001:1996 requirements into its ISMS with the intention of self-declaring conformance. The LLNL EMS is defined in the LLNL ISMS Description, and its requirements are in the LLNL *ES&H Manual*. The integration of ISO 14001:1996 requirements into the LLNL ISMS fulfills requirements in the University of California–Department of Energy contract for LLNL to maintain an environmental management program consistent with DOE-approved parameters. LLNL self-declared its conformance with ISO 14001:1996 in December 2005.

The LLNL EMS promotes responsible environmental stewardship practices that are protective of the air, water, land, and other natural and cultural resources; complies with applicable environmental regulations in a cost-effective manner; and focuses on continuous improvement of LLNL's environmental system. LLNL's senior management has committed to achieve continuous improvement in operational and environmental performance through P2 and other sustainable business tools.

### Overview and General Requirements

The LLNL EMS is applicable to LLNL facilities and operations located at the Livermore Site and Site 300, and offsite activities, products and services that it can control and over which it can be expected to have an influence. LLNL Nevada Test Operations are subject to the requirements of the Nevada Test Site, and are not addressed in the LLNL EMS. The LLNL EMS centers on management of environmental aspects. Environmental aspects at LLNL are managed in accordance with ISMS requirements. Each LLNL directorate is responsible for supporting institutional environmental objectives and targets where appropriate, as well as managing and reducing the negative impacts of significant environmental aspects that are specific to the directorate and its work activities, products, and services.

P2 is a critical part of the LLNL EMS. **Table 3-1** shows the applicability of P2 to each of the elements of the EMS.

**Table 3-1.** Pollution Prevention in the LLNL EMS

EMS Element	Pollution Prevention Connection
Environmental Commitment and Policy	P2 included in LLNL environmental policy by senior management
Planning	<p>P2 principles assimilated into environmental planning and decision-making at the institutional as well as at the directorate level.</p> <p>P2 Opportunity Assessment (PPOA) methods used to identify significant aspects.</p> <p>PPOA methods employed to evaluate EMS objectives, targets, and mitigation approaches in terms of environmental benefit and technical and economic feasibility.</p>
Implementation and Operation	P2 Team support to EMS Team: Project expertise, database interface, financial support identification, document preparation, assistance performing Self-Assessments, interface with community, performance testing.
Checking and Corrective Action	Corrective measures are accomplished through Return-On-Investment (ROI) projects, process changes funded by programs, and informal cooperation between LLNL programs, P2 Team staff, and EPD environmental analysts leading to improved environmental performances.
Periodic Management Review and Continuous Improvement	P2 Team support of self-assessment process and use of self-assessment reports in generating P2 documents.

All LLNL environmental aspects and regulatory or other identified requirements are managed according to the *ES&H Manual*. Environmental Management Programs (EMPs) are prepared for projects and studies that are not specifically addressed in the *ES&H Manual*, Integration Work Sheets (IWSs), or National Environmental Policy Act (NEPA) mitigation measures, and for aspects that have not been traditionally managed under ISMS (electrical energy use, water use, etc.).

## Environmental Policy

On July 22, 2004, the Laboratory Director issued LLNL's Environmental Policy, which was distributed to all LLNL employees. This policy, described below, is the basis on which the EMS was developed:

LLNL is committed to providing responsible stewardship of the environmental resources in our care. Environmental stewardship is integrated into our strategic planning and decision-making processes and into the management of our work activities through the Integrated Safety Management System.



In support of this policy, LLNL commits to

- Work to continuously improve the efficient and effective performance of our environmental management system;
- Comply with applicable environmental laws and regulations;
- Incorporate pollution prevention, waste minimization, and resource conservation into our planning and decision making processes;
- Ensure that interactions with our regulators, DOE, and our community are based upon integrity, openness, and adherence to national security requirements;
- Establish appropriate environmental objectives and performance indicators to guide these efforts and measure our progress.

The Environmental Policy is found in the *ES&H Manual*, Section 3.0 of Document 1.2, ES&H Policies of LLNL.

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## Identification of Significant Environmental Aspects and Their Impacts

The ISO 14001:1996 standard requires the identification, determination-of-significance, and mitigation of environmental aspects to drive and measure environmental protection improvements within work activities, facilities, and the institution. Significant environmental aspects are those that have or can have a significant environmental impact (that is, any change to the environment, whether adverse or beneficial, wholly or partially resulting from an organization's activities, products, or services). The management of environmental aspects, with emphasis on those that are significant, is key to the success of an EMS. In 2005, LLNL developed its initial set of significant environmental aspects through the process described below.

### Identification of LLNL Activities, Products, and Services

A comprehensive list of LLNL activities, products, and services was developed using several existing resources, starting with the Work and Associated Hazard database used to develop the original LLNL WSS set in 1998 and 1999. This database provided descriptions of buildings or work areas broken into work categories, work elements, work activities, and hazard categories.

A shortened activity list was generated from the database by compiling activities into categories. For example, the Laser Operations category includes installation, maintenance, repair, and operation of lasers throughout LLNL. The shortened activity list was augmented with activities, products and services from current IWSs, the 2005 *Final Site-wide Environmental Impact Statement for the Continued Operation of Lawrence Livermore National Laboratory and Supplemental Stockpile Stewardship and Management Programmatic Environmental Impact Statement (LLNL SW/SPEIS)*, other ISMS environmental and safety documents, and LLNL personnel knowledge. The initial list of the activities, products, and services was reviewed and updated by LLNL program and facility personnel, as well as environmental analysts supporting those programs and facilities.

## Identification of LLNL Environmental Aspects

The EMS requires that LLNL identify its environmental aspects and associated environmental impacts based on its activities, products and services. LLNL developed an initial list of environmental aspects by evaluating each activity, product, or service from the list described in the previous paragraph. This initial list of environmental aspects was augmented using other existing resources, such as IWSs, ISMS environmental and safety documents, and LLNL personnel knowledge. The list of environmental aspects (**Table 3-2**) was reviewed and updated by LLNL program and facility personnel, as well as environmental analysts supporting those programs and facilities.

**Table 3-2.** LLNL's Environmental Aspects

<b>Radioactive material use</b>	Radioactive air emissions
<b>Electrical energy use</b>	Discharges to ground
<b>Renewable energy use</b>	Greenhouse gas emissions
<b>Mixed waste (MW) generation</b>	Low-level radioactive waste (LLW) generation
<b>Nonhazardous materials use</b>	Environmental noise
<b>Municipal waste generation</b>	Hazardous air pollutant emissions
<b>Fossil fuel consumption</b>	Energy emissions
<b>Hazardous materials use</b>	Medical/biological waste generation
<b>Transuranic (TRU) waste generation</b>	Biological material use
<b>Ecological resource disturbance</b>	Water use
Criteria pollutant emissions	Land use/land management
Discharges to arroyo/surface waters	Cultural resources disturbance
Discharges to sanitary sewer system	Industrial waste generation
Hazardous waste (HW) generation	Other air emissions (odors, etc.)
Discharges to storm drain system	

Note: LLNL's Significant Environmental Aspects for calendar year 2005 are in bold.

## Determination of Environmental Impacts

As environmental aspects were identified, associated environmental impacts were also determined. LLNL utilized existing resources, such as the LLNL *SW/SPEIS*, ISMS documents, and environmental personnel knowledge to determine the environmental impacts associated with each aspect.

## Identification of Significant Environmental Aspects

LLNL developed a Significance Criteria matrix or table that identified its significant environmental aspects. The development of the significant environmental aspects included consideration of both environmental and business factors, as is recommended by ISO 14004:1996<sup>1</sup> (**Table 3-3**).

**Table 3-3.** Environmental and business factors used for evaluating environmental aspects

Environmental Factor	Business Factor
Scale of the impact	Potential regulatory and legal exposure
Severity of the impact	Difficulty of changing the impact
Probability of occurrence	Cost of changing the impact
Duration of impact	Effect of change on other activities and processes Concerns of interested parties

Source: ISO 14004:1996, EMS—General guidelines on principles, systems and supporting techniques

LLNL's business and environmental factors and description of low, moderate, and high impacts are described in a Significance Criteria table (**Table 3-4**).

The environmental aspects were then scored based on the Significance Criteria table. The scoring of environmental aspects considered the following assumptions that were globally applied to all aspects:

- Application of both environmental and human health impacts
- Impacts that occur both within a facility, exterior to the facility, and beyond the LLNL fence line
- Impacts from both normal operations and upset conditions, including the assumptions behind a worst-case scenario

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<sup>1</sup> ISO 14004:1996 provides guidance on the establishment, implementation, maintenance, and improvement of an environmental management system and its coordination with other management systems.

**Table 3-4.** LLNL environmental aspects significance criteria

Factors	Impacts		
	Low	Moderate	High
Laws, Regulations, Standards (LRS)	There are no established LRSs to address impact; or there are established LRSs to address impact, and impact is within compliance requirements.	There are established LRSs to address impact, and impact approaches compliance requirements; or impact does not result in a regulatory violation/fine.	There are established LRSs to address impact, and impact has exceeded the LRSs reporting thresholds, or fails to meet compliance requirements.
Perceptions	Interested parties do not express an opinion; or no negative or positive opinions of impact.	Interested parties identified impact that warrants monitoring; or an interested party expresses a strong view (either positive or negative) concerning the impact; or an interested party's view does not negatively influence other interested parties' perceptions.	Strong views (either positive or negative) concerning the impact are expressed by multiple interested parties; or expressed views result in increased media attention and/or interested parties oversight and/or public controversy.
Controls	No controls needed to mitigate impact. Impact identified, but is self-remediating with little or no resources needed.	Identified impact eliminated through the use of controls, engineered or administrative.	Identified impact mitigated to moderate impact level through the use of administrative and engineered controls.
Scale	Impacts are localized to the work area or are limited to personnel involved in the work area; or an accident could result in "Alert" emergency status on-site.	Impact is contained within LLNL site boundaries; impacts Lab population only; or an accident could result in "Site Area Emergency" on-site.	Impacts are not limited to LLNL sites; impacts surrounding community or region; or an accident could result in "General Emergency" in surrounding communities.
Severity & Duration	No long-term impact; impact is self-remediating with little or no resources needed.	Impact is recoverable over a long period of time, with the expenditure of resources.	Impact is not recoverable or is permanent.
Frequency & Probability	Frequency of occurrence is low (i.e., is less than 5% of the number of LLNL related activities).	Moderate frequency of occurrence (i.e., the number of LLNL related activities is equal to or greater than 5% and less than or equal to 95%).	High to very high frequency of occurrence (i.e., greater than 95% of the number of LLNL related activities).
Reuse and Recycling Opportunities	Minimal or no resource depletion is expected; reuse, recycling or waste minimization opportunities are not available or needed.	Resource depletion is moderate; reuse, recycling, or waste minimization opportunities may be available with some cost avoidance.	Resource depletion is high; reuse, recycling, and waste minimization could significantly reduce impacts to programs, schedules, and/or costs.

**Table 3-4.** LLNL environmental aspects significance criteria (continued)

Factors	Impacts		
	Low	Moderate	High
Operational & Technical Limitation	Impacts to programs, schedules, and costs are small; or administrative and engineering controls are not needed; or technology to manage the impact does not exist or is in the experimental stage.	Moderate impacts to programs, schedules, and/or costs; some administrative and engineering control opportunities are available. Technologies are limited or requires significant modifications.	High impacts to programs, schedules, and costs; engineering and administrative controls could reduce impacts. Technology is readily available and proven. Operations can be implemented with existing staff and equipment.
Ability and Cost of Change	Do not have ability to change; or no significant results are expected if changes were made; or cost of change is prohibitive.	Will have some ability to change, but moderate results are expected; cost of change is moderate.	Will have ability to effect change; significant results are achievable if change is implemented; cost of change is minimal.

The specific assumptions used to score each LLNL environmental aspect were documented.

LLNL's significant environmental aspects are listed in **Table 3-2**.

As a part of the process for annual review and revision of LLNL's environmental aspects, the LLNL EMS Coordinator and the LLNL EMS Team reevaluate the significance criteria and determine whether any newly identified aspects are significant using a process similar to the one described here. The LLNL EMS Team briefs programmatic and facility organizations on an as needed basis to advise them of the changes and solicit input to the process of identifying significant environmental aspects.

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## Identifying and Managing Environmental Targets and Objectives

ISO 14001:1996 requires the establishment and maintenance of documented environmental targets and objectives for each relevant function and level within the organization. When establishing and reviewing its targets and objectives, LLNL considers legal and other requirements; significant environmental aspects; technological options; financial, operational, and business requirements; and the views of interested parties. The objectives and targets are consistent with the environmental policy, including the commitment to prevent pollution.

LLNL has identified targets and objectives for its significant environmental aspects, the measurements (or metrics) that will be used to track each target, as well as the projected cost of implementation. Where appropriate, LLNL utilizes activities and programs that are already in place to achieve targets and objectives. When targets for measuring management of significant environmental aspects cannot easily be identified, studies are performed to establish baselines and determine a path forward. The established set of environmental objectives and targets are reviewed annually (or more frequently if needed) and revised as necessitated by changes to regulatory or program requirements, or other influencing factors. The need to develop and implement new objectives is evaluated whenever new significant environmental aspects are identified. See **Table 3-5** for a summary of the objectives for LLNL's significant environmental aspects.

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## Establishing and Maintaining Environmental Management Programs (EMPs)

The targets and objectives for each significant environmental aspect are managed through an Environmental Management Program (EMP), which assigns responsibilities for achieving the goals for that aspect. The EMP Lead assigned to each EMP is responsible for collecting information and working with the appropriate Program representative(s) to negotiate actions to be incorporated in the EMP. Each EMP includes schedules, resources, operational controls, records generated, and responsibilities for achieving the environmental objectives and targets applicable to it. Where appropriate, documents that define operational controls applicable to the EMP (e.g., IWSs, studies, and mitigations required by NEPA) are referenced. The EMP Lead works with the Program representative(s) and the EMS Team when preparing the EMP. The EMS Coordinator must approve the completed EMP before it is implemented.

The EMS Coordinator and the LLNL EMS Team review progress on each EMP annually (or more frequently if needed) and work with EMP Program Leads to revise EMPs as necessary. The EMS Coordinator and EMS Team ensure that new EMPs are developed and implemented as needed.

### Senior Management Review

LLNL senior management reviews the EMS at least annually (and more frequently if needed) as required by ISO 14001:1996. Each review must be comprehensive; however, not all elements of the EMS are required to be included.



**Table 3-5.** Objectives for significant environmental aspects

Significant Environmental Aspect	Objective
Radioactive Material Use	Identify and reduce radioactive materials impacts at LLNL by an amount to be determined by this study
Electrical Energy Use	<ul style="list-style-type: none"> <li>• Meet the objectives provided in DOE Order 430.2A, "Departmental Energy and Utilities Management"</li> <li>• President's Initiative for Hurricane Relief (September 2005)</li> </ul>
Mixed Waste (MW) Generation	Reduce the amount of mixed and California combined solid waste generated from routine LLNL Programmatic operations when economically and technologically feasible
Nonhazardous Materials Use	<ul style="list-style-type: none"> <li>• Incorporate affirmative procurement site-wide</li> <li>• Increase site-wide use of products with recycled content</li> <li>• Continue EPD's participation in the Federal Electronics Challenge (FEC)</li> </ul>
Municipal Waste Generation	<ul style="list-style-type: none"> <li>• Maintain compliance with applicable regulatory requirements</li> <li>• Prevent/reduce waste generation and increase reuse/recycling of routine and nonroutine waste that would otherwise be disposed of at a municipal landfill</li> </ul>
Fossil Fuel Consumption/Renewable Energy Use	Meet the DOE Vehicle Fleet Efficiency goal, in I.106 DEAR 970.5223-5
Hazardous Materials Use	Conduct a study to identify the databases or other information sources that provide a comprehensive list of hazardous materials
Transuranic (TRU) Waste Generation	Conduct a study to review the characterization of transuranic waste to ensure generation of nonconforming waste is minimized and characterization is accurate to maximize the ability to disposition the waste.
Ecological Resources Disturbance	<ul style="list-style-type: none"> <li>• Establish Laboratory policy prohibiting the introduction of exotic species within the borders of LLNL</li> <li>• Control exotic species to benefit native threatened species as need is determined</li> </ul>

The EMS Coordinator prepares the necessary input to be considered in the management review. The following topics are typically included:

- Review of environmental objectives and targets and the extent to which they have been met
- Findings of EMS audits and results of Directorate self-assessments

- Regulatory compliance status
- Follow-up actions from previous audits
- Changing circumstances, including developments in legal and other requirements related to significant environmental aspects

## Recommendations for Improvement

Upon review of the above information, senior management determines the continuing effectiveness of the EMS implementation, specifically the ability of LLNL to achieve its documented objectives and targets. Senior management also determines whether the system continues to be adequate and suitable for its intended purpose.

Having made these determinations, senior management provides a response to the EMS Coordinator that includes any changes that must be made to the EMS to ensure its continual improvement. Senior management directives may include changes to the environmental policy, targets and objectives, and other elements of the EMS.

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## LLNL's Self Declaration Process

To conform with the requirements of Executive Order 13148 (Greening the Government Through Leadership in Environmental Management), LLNL initiated an internal review process to facilitate self-declaration of conformance with ISO 14001:1996. An internal EMS audit was conducted November 9 and 10, 2005.

Subsequent to the internal audit, the Livermore Site Office (LSO) of the Department of Energy (DOE) also conducted an independent evaluation of LLNL's existing EMS against the requirements specified in ISO14001:1996. The purpose of this evaluation was to fulfill the LSO requirement to conduct an independent review and determine whether the LLNL EMS met the intent of ISO 14001:1996, was being implemented, and was effective. More than 145 documents and websites were reviewed, and approximately 48 interviews were conducted. The audit team could not fully assess implementation or measure the effectiveness of the LLNL EMS because the EMS documents were completed and the system was implemented just prior to the audit.

The LSO audit resulted in no major nonconformances (a major nonconformance is a missing system element, or evidence that a system element is not implemented or not effective); 13 minor nonconformances (a minor nonconformance is a single observed discrepancy in the system, with evidence that the overall system is defined, implemented, and effective);

8 observations (an observation is not a nonconformance, but something that could lead to a nonconformance if allowed to continue uncorrected, or an existing condition without adequate supporting evidence to verify that it constitutes a nonconformance); 20 opportunities for improvement (OFI) (an OFI is a suggested or recommended means of accomplishing an activity, fulfilling the intent of a procedural requirement, or improving the efficiency or effectiveness of the EMS); and 22 noteworthy practices (a noteworthy practice is performance that exceeds expectations in terms of efficiency and/or effectiveness and provides a model for others to follow).

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## Corrective Action Plan (CAP) and Self-Declaration

DOE/LSO agreed to validate the self-declaration of LLNL's EMS upon submittal of a draft Corrective Action Plan (CAP) that contained corrective actions specific to the minor nonconformances identified in the LSO audit. LLNL prepared the draft CAP and submitted it to LSO on December 20, 2005. LLNL and LSO agreed that observations and OFIs would not be addressed in the CAP but they would be entered and tracked to closure in the LLNL Issues Tracking System (ITS).

On December 22, 2005, LLNL provided DOE with a self-declaration of LLNL's EMS based on the audit performed by DOE/LSO and the draft CAP that was submitted.

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## Path Forward

During 2006, LLNL will implement the corrective actions that will address the deficiencies identified in the DOE/LSO audit. In addition LLNL will submit the ISO 14001:2004 Standard to the Change Control Board so that it can be added as a WSS and begin the process of updating the existing EMS to meet the requirements of the 2004 standard. LLNL will continue to work towards meeting its EMS targets and objectives and will perform reviews and measurement to ensure they are appropriate and that progress is being made.

## Pollution Prevention

The LLNL P2 team facilitates LLNL's P2 program within the framework of the ISMS and EMS and in accordance with applicable laws, regulations and DOE orders as required within the UC Contract. P2 team responsibilities include P2 program stewardship and maintenance, waste stream analysis, reporting of waste generation and P2 accomplishments, and fostering of P2 awareness through presentations, articles, and events. The P2 team

supports institutional and directorate P2 activities via environmental teams, including implementation of source reduction and/or reclamation, recycling, and reuse programs for hazardous and nonhazardous waste, facilitation of the environmentally preferable procurement (EPP) program, preparation of P2 opportunity assessments, and development and management of high return-on-investment projects. LLNL's P2 program is described in Document 30.1 in LLNL's *ES&H Manual*.

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## DOE Pollution Prevention Goals

In 1999, DOE developed pollution prevention and energy efficiency leadership goals for DOE facilities in response to presidential executive orders for the Greening of the Federal Government. The pollution prevention goals are compared in **Table 3-6** with LLNL's quantities of routine waste generated in 1993 (i.e., LLNL's baseline), its 2005 target, the actual amount of waste generated in 2005, and the percent reduction in 2005 compared with the baseline. Routine waste described in **Table 3-6** includes waste from ongoing operations produced by any type of production, analysis, and/or research and development taking place at the Laboratory. Periodic laboratory or facility clean-outs and spill cleanups that occur as a result of these processes are also considered normal operations. Residues, resulting from the treatment of routine waste in the RHWM facilities on site are not included to avoid double counting.

The following five energy efficiency goals were included in the leadership goals. **Table 3-7** lists the goals, baseline quantities, the 2005 targets when applicable and provides the status for each goal.

- Reduce energy consumption per gross square foot in the Laboratory & Industrial Facilities category by 20% by 2005 and 25% by 2010 relative to 1990.
- Increase the use of clean energy sources (renewable and low greenhouse gas energy).
- Retrofit or replace 100% of chillers with capacity greater than 150 tons that use Class I refrigerants by 2005.
- Eliminate the use of Class I ozone-depleting substances.
- Reduce greenhouse gas emissions attributed to facility energy use through life-cycle cost-effective measures by 25% by 2005 and 30% by 2010, using 1990 as a baseline.<sup>1</sup>

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<sup>1</sup> DOE Order 430.2A, Section 1, Objectives, lists the 2005 target as a DOE goal. The Contractor Requirements Document, Attachment 1 to the Order, only mentions the 2010 goal.

**Table 3-6.** Pollution prevention leadership goals at LLNL

Goal	Item	1993 baseline quantity	2005 target based on DOE leadership goal	2005 LLNL target commitment	2005 actuals	Percent reduction since 1993	Percent of 2005 target
1	Routine Hazardous Wastes Generated (90% reduction of 1993 baseline)	1054 MT <sup>(a)</sup>	105.4 MT	105.4 MT	127 MT	88	98
1	Routine Mixed Waste Generated (80% reduction of 1993 Baseline)	26 m <sup>3</sup>	5.2 m <sup>3</sup>	5.2 m <sup>3</sup>	16 m <sup>3</sup>	38	48
1	Routine Low-level Waste Generated (80% reduction of 1993 baseline)	346 m <sup>3</sup>	69.2 m <sup>3</sup>	69.2 m <sup>3</sup>	54 m <sup>3</sup>	84	105
1	Routine TRU/Mixed TRU Waste Generated (80 % reduction of 1993 baseline)	12.0 m <sup>3</sup>	2.4 m <sup>3</sup>	2.4 m <sup>3</sup>	1 m <sup>3</sup>	92	115
3	Routine Sanitary Waste Generated (75% reduction of 1993 baseline)	5873 MT	1468 MT	1468 MT	5116.5 MT	13	17
4	Routine Sanitary Wastes Recycled (45% of waste generated)	N/A	45% of 2005 sanitary waste	45% of 2005 sanitary waste	3386.4 MT	66% of 2005 sanitary waste	N/A
6	Purchases of EPA-designated items with Recycled Content (100% by cost of recycled versus nonrecycled)	N/A	100%	— <sup>(b)</sup>	\$3.768M/ \$6.382M	59%	59%
2	TRI Chemical Releases (90% of 1993 Baseline)	3983.3 lb <sup>(c)</sup>	398.3 lb	398.3 lb	471.9 lb (Site 300) 0 lb (Livermore site) <sup>(d)</sup>		
10	Eliminate use of Class 1 ozone-depleting substances by 2010	NA	0	The current schedule based on life-cycle cost-effective use of existing chillers and one halon fire-suppression unit shows five chillers and up to three fire-suppression units being replaced after 2010.			

a MT = metric ton

b LLNL was not able to meet this goal by 2005.

c In 2005, lead was the only toxic chemical that had exceeded the TRI reporting threshold at LLNL. In just four years, from 2001 to 2005, Site 300 reduced the amount of TRI-reportable lead from 3983 lbs to 471.9 lbs, a reduction of 88%.

d In 2005, the requirement to carry out TRI reporting for lead at the Livermore site was triggered by exceeding the threshold for on-site use of lead. Reporting "0 pounds" for on-site releases indicates that the total quantity of lead released on site was less than 0.05 pounds for the calendar year.

**Table 3-7.** Energy efficiency leadership goals at LLNL

Goal	Item	1990 baseline quantity	2005 target based on DOE leadership goal	Status
7	Reduce Unit Energy Consumption 20% by 2005 and 25% by 2010 for lab and industrial facilities	289,600 BTU/gross ft <sup>2</sup>	231,700 BTU/gross ft <sup>2</sup>	As of FY 2005, LLNL has met the goal, with consumption of 229,100 BTU/gross ft <sup>2</sup> .
8	Request for bid packages for energy supply with clean energy provisions (100% of requests with provisions versus those without)	N/A	100%	Because NNSA purchases LLNL's electricity, LLNL cannot commit to meeting this goal.
8	Purchase of electricity from sources with low greenhouse gas emissions (% of electricity from less greenhouse gas intensive sources to total consumption)	N/A	100% of all future DOE competitive solicitations for electricity	Because NNSA purchases LLNL's electricity, LLNL cannot commit to meeting this goal. However, during FY 2005, LLNL worked through the Western Area Power Administration to purchase Renewable Energy Credits (RECs) with other DOE facilities in the San Francisco Bay Area.
9	Replacement of chillers (100% of total 150 ton [or larger] pre-1984 units with Class I refrigerants replaced)	7 (number of units in use in 1999)	0	The current schedule based on life-cycle cost-effective use of existing equipment shows three chillers being replaced by 2007.
11	Reduce greenhouse gas emission from facility energy use (30% of greenhouse gas emission reduced relative to 1990 baseline by 2010)	(1990 baseline) 143,059.4 MT <sup>a</sup>	(2010 target) 100,141.6 MT	Because NNSA purchases LLNL's electricity, LLNL cannot commit to meeting this goal. In 2005 LLNL emitted 121,127.3 metric tons. Note: While DOE has a goal of 25% reduction by 2005 (DOE O 430.2A, Attachment 1), it is not included in LLNL contract requirements.

a MT = metric ton

This will be the last year that LLNL reports on the 1999 Pollution Prevention/Energy Efficiency Goals. DOE/NNSA have developed new performance-based goals (approved in 2005) for 2006 and beyond. These goals are described in Attachment 3 to DOE O 450.1.

In 2001, LLNL revised the method by which it calculates waste to better identify future P2 opportunities and to eliminate categories of wastes that would otherwise be counted twice under the RHW Division's Total Waste Management System (TWMS) database, which was replaced in FY 2004 with a new database called HazTrack. The quantities for hazardous waste, low-level radioactive waste, and mixed low-level waste reported in HazTrack now include all wastes generated under requisition.



## Pollution Prevention Program

The P2 Program at LLNL strives to systematically reduce solid, hazardous, radioactive, and mixed-waste generation, and eliminate or minimize pollutant releases to all environmental media from all aspects of the site's operations. These efforts help protect public health and the environment by reducing or eliminating waste, improving resource usage, and reducing inventories and releases of hazardous chemicals. These efforts also benefit LLNL by reducing compliance costs and minimizing potential civil and criminal liabilities under environmental laws. In accordance with EPA guidelines and DOE policy, the P2 Program uses a hierarchical approach to waste reduction (i.e., source elimination or reduction, material substitution, reuse and recycling, and treatment and disposal) applied, where feasible, to all types of waste. The P2 team tracks waste generation using the HazTrack database. By reviewing the information in this database, program managers and P2 staff can monitor and analyze waste streams to determine cost effective improvements to LLNL operations.

### Diverted Waste

Together, the Livermore site and Site 300 generated 5116.5 metric tons of routine nonhazardous solid waste in 2005. This volume includes diverted waste (for example, material diverted through recycling and reuse programs) and landfill wastes. LLNL generated 6492.5 metric tons of nonroutine nonhazardous solid waste in FY 2005. This includes waste that is reused as cover soil at Class II landfills or is recycled through the nonroutine metals recycling programs. Nonroutine nonhazardous solid wastes include wastes from construction, and decontamination and demolition activities. In FY 2005, the portion of nonhazardous waste (routine and nonroutine) sent to landfill was 2905.4 metric tons. The routine portion was 1730.1 metric tons and the nonroutine portion was 1175.3 metric tons. The breakdown for routine and nonroutine nonhazardous waste that was sent to landfills in FY 2005 is shown in **Table 3-8**.

**Table 3-8.** Total nonhazardous waste sent to landfills in FY 2005

Nonhazardous waste	2005 total (metric tons)
<b>Routine</b>	
Compacted (landfill)	1730.1
<b>Nonroutine</b>	
Construction demolition (noncompacted landfill)	1083.3
Industrial (TWMS and HazTrack <sup>(a)</sup> )	92.0
Nonroutine subtotal	1175.3
<b>LLNL total</b>	<b>2905.4</b>

a RHWMS Waste Data Management Systems

Together the Livermore Site and Site 300 diverted 3386.4 metric tons of routine nonhazardous waste in 2005. This represents a diversion rate of 66%. This diversion rate includes waste recycled by RHW and waste diverted through the surplus sales program. The total routine and nonroutine waste diverted from landfills through LLNL's comprehensive waste diversion program was 8703.6 metric tons in FY 2005 (**Table 3-9**).

**Table 3-9.** Diverted waste in FY 2005

Waste description	Cumulative 2005 total (metric tons)
<b>Routine</b>	
Batteries (small)	5.4
Batteries (lead-acid)	27.6
Beverage containers	6.6
Cardboard	140.2
Compost	414.2
Cooking grease	2.4
Magazines, newspapers, and phone books	31.4
Metals	1857.2
Paper	300.4
Street sweepings	77.5
Tires and scrap	25.3
Toner cartridges	9.1
Wood pallets	489.6
<b>Total routine waste diverted</b>	<b>3386.4</b>
<b>Nonroutine</b>	
Asphalt/concrete	3547.2
Class II Cover	1027.3
Miscellaneous	5.6
Nonroutine metals	637.2
Offsite daily cover/onsite reuse	99.7
SAT Freon	0.2
<b>Total nonroutine waste diverted</b>	<b>5317.2</b>
<b>LLNL diversion total</b>	<b>8703.6</b>

## Pollution Prevention Activities

During the summer of 2005, EPD's Water Guidance & Monitoring Group and the Energy Management Program collaborated to audit LLNL Livermore site restroom facilities. The audit findings are being used to develop several water conservation retrofit projects. The first project submitted for

consideration in LLNL's FY07–FY09 Institutional Investments Facility and Infrastructure (F&I) call for proposals consists of replacing existing flushometers serving women's toilets with dual-volume flushometers. Significant cost savings are anticipated from reduced water, sewage, and pumping requirements.

During FY 2005, LLNL arranged, with other San Francisco Bay Area DOE facilities, to purchase Renewable Energy Credits (RECs) through the Western Area Power Administration. LLNL's portion of the purchase totals 13,220.1 megawatt-hours per year annually for 5 years. This represents about 3.7% of annual LLNL electric power consumption and is a source emissions reduction of about 3,657 metric tons per year (carbon dioxide equivalent).

Since October 2003, EPD has been participating in the Federal Electronics Challenge (FEC), a voluntary partnership program that encourages federal facilities and agencies to purchase greener electronic products, reduce impacts of electronic products during use, and manage obsolete electronics in an environmentally safe way. During 2005, objectives and targets related to the FEC and development of a lab-wide electronics management strategy were incorporated into LLNL's Environmental Management System via the Environmental Management Program (EMP) for nonhazardous materials use. LLNL also began recordkeeping for the Electronics Recycling and Reuse Challenge (ERRC). The ERRC is an FEC initiative that poses a friendly "competition" between federal facilities to see which can reuse and recycle the most surplus computers and other electronics between America Recycles Day (November 15, 2005) and Earth Day (April 22, 2006).

In December 2005, DOE NNSA selected four projects at the Livermore site, Site 300, and the Nevada Test Site to receive pollution prevention awards: three DOE Best-in-Class awards and one DOE Environmental Stewardship award.

The first Best-in-Class award was for LLNL's Space Action Team (SAT) implementation of Assets for Value strategies as a core element of its facility management and D&D processes. This innovative strategy provides a contractual mechanism for converting the value of equipment or building materials into an offset against payment for contracted demolition work. Assets for Value lowers facility operating costs, reduces D&D contracting costs, eliminates waste streams, increases reuse of materials, and increases material recycling.

The second Best-in-Class award was for a pollution prevention/health and safety measure implemented at Site 300's Experimental Explosive Facility—the replacement of sulfur-hexafluoride with an ultra-zero compressed air for use as a dielectric in a portable flash x-ray system. This replacement has the substantial pollution prevention benefit of eliminating the use of a potent greenhouse gas that also, as an asphyxiant, poses a serious health and safety

concern. Of additional benefit is the cost savings associated with use of the Ultra-Zero air, and the concern that SF-6 availability may be limited in the future.

The third Best-in-Class award went to the Joint Actinide Shock Physics Experiment Research (JASPER) gas gun project at the Nevada Test Site, for the incorporation of waste minimization and pollution prevention into the design, execution, and maintenance of the project. JASPER, managed by LLNL, provides data for the dynamic properties of nuclear materials of interest to the stockpile stewardship program. At onset, rather than building a new facility the JASPER project was constructed within an existing facility. The gas gun was manufactured from metal that was recovered from a canceled project. Double containment design features prevent both the escape of contamination and generation of low-level waste. During operations many of JASPER's surrogate shot parts are reusable. Collection cables, originally taken from stock left over from nuclear testing operations, are used outside primary containment, permitting reuse for multiple shots. Additionally, at JASPER recycled chemicals are used as a first choice.

LLNL's Contained Firing Facility (CFF) at Site 300 received a DOE Environmental Stewardship award for their integration of pollution prevention and water conservation during the development of operations practices. The containment of explosives and nondestructive testing within the CFF provides greater environmental protection than provided in the controlled, outdoor firing areas because there are no hazardous emissions to the environment. However, following an experiment, the CFF chamber requires cleaning to remove hazardous and radioactive contamination. The CFF staff have developed and implemented both an inexpensive low-tech method of particulate capture, and an extensive water recycling and polishing system. These practices and system facilitate the cleaning process, reduce the quantity of waste generated as a result of cleaning, save worker time, improve worker safety, and increase the availability of the chamber.

All four award nominations were forwarded to the Office of the Federal Environmental Executive for the 2006 White House Closing-the-Circle (CTC) Awards. The CTC program recognizes outstanding efforts and achievements of Federal employees and their facilities in promoting environmental stewardship.

## **Energy Management Program Projects**

The primary responsibility of the LLNL Energy Management Program is to track and report LLNL's compliance with DOE Order 430.2A and to promote energy efficiency and water conservation onsite. The Energy Management Program completed three energy efficiency projects during FY 2005 and

began a fourth project supported by Federal Energy Management Program (FEMP) funds with LLNL cost sharing.

- **Energy & Water Conservation Audit of Trailer, Modular, and Prefabricated Buildings**

During FY 2005, LLNL completed energy efficiency and water conservation audits contracted during FY 2003. All LLNL trailer, modular and prefabricated buildings were inspected to identify energy and water conservation measures. These audits were supported jointly by funds awarded from the DOE–FEMP Model Program study and by the LLNL–Energy Management Program (LLNL–EMP). These audits represent about 12.9% of the LLNL baseline floor area and total more than 917,000 square feet. Energy Conservation Measures recommended for implementation are addressed below.

- **Site 300 Heating, Ventilating and Air Conditioning (HVAC) Direct Digital Controls (DDC) Retrofit**

This retrofit was cost-shared between DOE–FEMP and the LLNL–EMP. The project involved replacing pneumatic controls with direct digital controls at several Site 300 buildings.

- **Building 451 Retrofit of Variable Frequency Drives (VFDs) and DDC Controls of Air Conditioning Units ACU-12 & ACU-13**

This retrofit is also a cost sharing effort between DOE–FEMP and the LLNL–Computations Directorate. The retrofit implemented an energy efficiency project recommended in 2001 by a DOE energy savings audit team sent to help during the California electrical emergency. This corrected a long-standing cause of energy waste.

- **Computerized Building Automation System, Version II (CBAS-II) Trailer / Modular Building HVAC System DDC Controls Pilot Project**

Jointly supported by DOE–FEMP Model Program and LLNL–EMP funding, this project was begun in FY 2005. The effort consists of installing a prototype, cost-effective DDC control system in a typical office trailer. The system provides space temperature control and scheduling, building power metering, and remote access via LLNL’s Lab-net. The system also provides the capability of “shelter-in-place” operations, improving employee safety in the event of a toxics release, by preventing air flow into and from the building.

During FY 2005, LLNL received two awards from the DOE–FEMP. One award was for a small group of National Ignition Facility (NIF) personnel who worked together to optimize HVAC systems, saving over \$758K per year of energy costs. The other award recognizes the individual contributions by LLNL’s Energy Manager, who was selected as an FY 2005 DOE–FEMP

Energy Champion for effective implementation of energy and water savings projects during his tenure.

## Return-on-Investment Projects

Implementation of three P2 projects, funded by DOE in late 2004 with DOE High-Return-on-Investment (ROI) funds, was completed this year.

- **Biodiesel Project for Medium Service Vehicles**

This pilot project brought B20, a blend of 20% biodiesel<sup>1</sup> and 80% petroleum diesel, onsite for trial in a selected group (LLNL's medium duty fleet) to evaluate use and maintenance issues, and to build user and management confidence in this alternative fuel. Use of B20 significantly reduces vehicle emissions of carbon monoxide (–13%), unburned hydrocarbons (–11%), particulates (–18%), and the greenhouse gas, carbon dioxide (–16%) as compared to petroleum diesel (World Energy; Howell 2003). Under the Energy Policy Act of 1992, use of biodiesel is an option for applicable federal fleets to meet a portion of their annual alternative fuel vehicle (AFV) acquisition requirements.

The pilot project, completed in late summer 2005, was deemed a success. Scheduled preventative maintenance for the vehicles did not reveal any problems associated with use of the fuel. At the end of the pilot, use of B20 continued at a low level as LLNL Fleet Management continues to develop their strategy to make use of this and other alternative (non-petroleum based) fuels.

- **Accelerated Solvent Extraction System for Preparation of Semivolatile Organic Compound/Polychlorinated Biphenyl Samples**

LLNL's Chemistry and Materials Science Environmental Services (CES) routinely analyzes radioactive waste samples for semivolatile organic compounds (SVOCs) and polychlorinated biphenyl (PCB) compounds; in the process, mixed, radioactive and hazardous solvent wastes are generated. This ROI project involved the purchase and application of an accelerated solvent extraction (ASE) system that uses high temperature and pressures to allow the extraction of SVOCs and PCBs from solid samples in less time and with less volume of solvent. Implemented in 2005, the project is expected to have a payback period of 1.6 years and will result in the diversion of 230 kg of mixed low-level waste and 1 kg of TRU waste each year.

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<sup>1</sup> Biodiesel is a renewable, domestically produced, and nontoxic diesel fuel substitute. It is a methyl ester most commonly derived from either soy or rapeseed oil.



- **Purchase and Application of a Flow-through Radionuclide Detector**

This project funded the Chemical Biology and Nuclear Science Division's Environmental Radiochemistry Group's purchase of a flow-through radionuclide detector system and accessories. Implemented in 2005, this detector system is used to detect multiple radionuclide contaminants in a waste stream. This project is expected to reduce the generation of mixed waste by 200 kg each year and will have a payback period of a little less than one year. The flow-through radionuclide detector also minimizes personnel exposure to hazardous and radioactive materials.

## **Review of New Processes, Programs, or Experiments**

During 2005 the Pollution Prevention Team actively participated in the planning and implementation of LLNL's EMS. (See the section "[Environmental Management System](#)" in this chapter.)

## **Pollution Prevention Employee Training and Awareness Programs**

In 2005, LLNL conducted a number of activities to promote employee awareness of Pollution Prevention. A key event, the annual Earth Expo, was held in April to coincide with Earth Day. It featured representatives from EPD, businesses with environmentally friendly products, environmental conservation organizations, utilities, environmental agencies, and other organizations with environmental charters and interests. During the course of the year, Pollution Prevention articles appeared in the LLNL newspaper, *Newsline*, and electronic newsletter, *NewsOnLine*. The P2 team conducted training for purchasing staff on EPA requirements for affirmative procurement. The P2 team also placed banners at entry gates for America Recycles Day and National Pollution Prevention Week.

The P2 team maintains a P2 web site (<http://www-p2.llnl.gov/>) for LLNL employees. The web site is a resource for employees regarding pollution prevention, energy efficiency, the reuse and recycling of materials, green building, and other environmental topics. Employees can also use the site to suggest P2 ideas, ask questions about P2 planning and implementation, and find out about P2 "current events." The P2 team also operates the Earth Hotline for employees to call with questions, suggestions, or ideas regarding LLNL's pollution prevention and waste diversion endeavors. During 2005 the P2 team brought an EMS web page online to facilitate communication about LLNL's EMS efforts.

## Contributing Authors

Many authors contributed to this diverse chapter. We acknowledge here the work of Bruce Campbell, Lucinda M. Clark, Katharine Gabor, Blair Horst, C. Susi Jackson, Hank Khan, Lily Sanchez, and Judy Steenhoven.